# NARROW CRAWL SPACE INCREASES CAPTURE OF COCKROACHES (BLATTODEA) IN ADHESIVE TRAPS[1]

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ABSTRACT: Cockroaches are a significant public health problem and are the most disliked urban pests. Cockroach control relies heavily on the use of chemical pesticides, which are equally disliked by the general public. Nontoxic, effective methods of eliminating cockroaches are in general demand. The double-surface habitat adhesive cockroach trap is a novel design that takes advantage of the cockroaches' predilection for narrow spaces as its major attractant. The trap also takes advantage of the broad, flat dorsal surface of the cockroach by utilizing adhesive on both the floor and the ceiling of the insects' crawl space. This trap was tested under laboratory conditions and found to be seven times more effective than popular Roach Motel®. The addition of pheromonal attractants might increase the effectiveness of the trap further.

KEY WORDS: Blattodea, nonchemical control, narrow crawl space, adhesive traps.

Cockroaches are probably among the most common and the most despised urban pests (Potter and Bessin 1998). Furthermore, they have been implicated as vectors of bacterial pathogens (Burgess and Chetwyn 1981, Graffer and Mertens 1960; Mackerras and Mackerras 1949) and may harbor these organisms for prolonged periods of time (Stek 1982, Stek, Peterson and Alexander 1978). More recent data suggest that cockroaches are an important etiological factor in human asthma (Rosenstreich et al. 1997, Sarpong et al. 1997). Among professional entomologists, cockroaches are responsible for 78 percent of occupational allergies (Wirtz 1980).

There are many approaches to cockroach control, including fumigation, directed spraying, and baited traps. In a survey of attitudes among the general public, Potter and Bessin (1998) found that 77 percent were either very or somewhat concerned about the use of pesticides to control insects in the home. As a consequence of this, the use of baited traps has greatly increased in recent years (Potter and Bessin 1998).

This report describes the laboratory effectiveness of an adhesive trap for cockroaches, where the "bait" is the cockroaches' own predilection for narrow crawl spaces. The trap's design also makes use of the insect's broad flat dorsal surface by having adhesive on both the "floor" and the "ceiling" of the trap. The results suggest that this is a very effective design.

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## METHODS

The trap is constructed of three sheets of cardboard measuring 11.5 x 15 cm and separated by spacers 5 mm high. The internal crawl spaces are lined with two-sided tape (Scotch Rug and Carpet Tape, 3M, St Paul, MN) (Figure 1). Since the trap was designed to utilize the cockroaches' behavioral predilection to tight spaces, it is called a "habitat" trap. Similar designs have been patented (Grey 1977, Gang 1995).

The testing of the traps was performed in plastic chambers measuring 41 x 21 x 18 cm. These were attached to each other by polyethylene tubing (2.5 cm diameter) to form a three-chambered testing arena (Figure 2). Ten adult American cockroaches *(Periplaneta americana)* were placed in the middle chamber, which also contained food (a cut apple) and water. One of the end chambers contained a Roach Motel® (Black Flag), and the other a habitat trap. The Roach Motel® is approximately 12 x 8 cm with a crawl space that is some 6 cm high. It contains a gel-like glue on both broad inside surfaces of the trap so that the trap can be placed on either side, however, the inside space is very large in relation to the size of the cockroach. The chambers were then sealed with a ventilated plastic cover and placed in the dark at 24 - 26°C for one week. At the end of that time, the chambers were opened and the cockroach position noted. The experiment was conducted in quadruplicate.

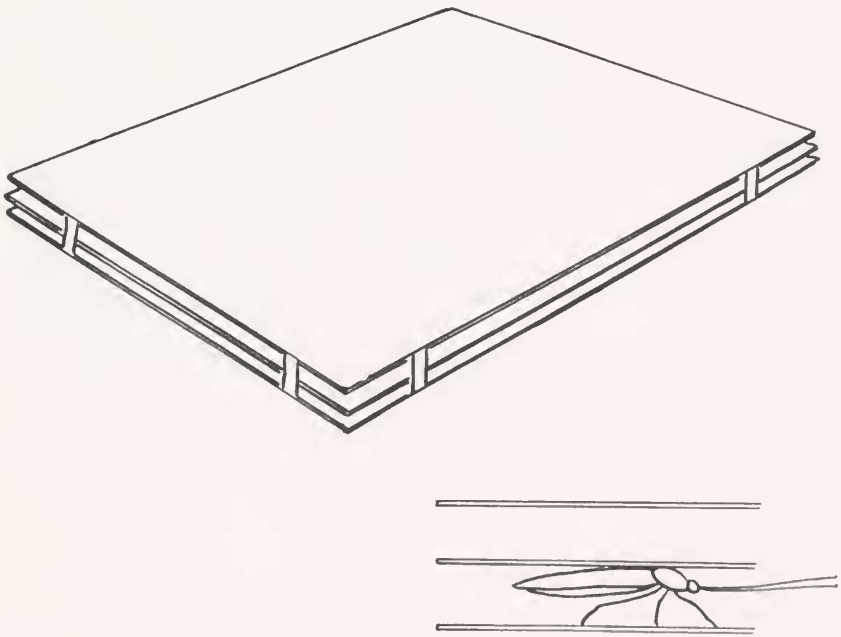

Figure 1. Schematic diagram of the habitat cockroach trap and an entrapped cockroach.

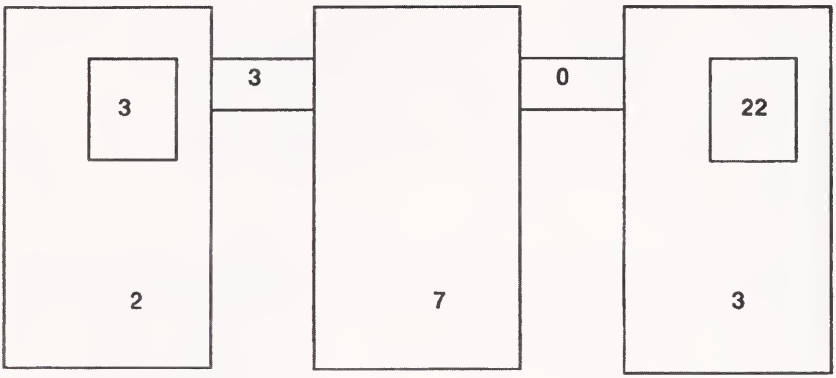


Figure 2. Schematic of the experiments comparing the Roach Motel® (left inner box) and the habitat trap (right inner box). Three identical plastic chambers were connected by plastic tubing. Ten adult *P. americana* were placed in the middle chamber (which also contained food and water), and the chambers were sealed for one week. At the time of the reopening of the chambers, the positions of the cockroaches were noted. The experiment was conducted in quadruplicate, for a total of 40 cockroaches.

## RESULTS AND DISCUSSION

Figure 2 presents the cockroach distribution at the end of one week for 40 cockroaches. The habitat trap captured over seven times as many cockroaches as the alternative baited adhesive trap ($P < 0.01$, $z = 5.06$, using a test for examining proportional data [El-Mallakh et al. 1994]). This is especially notable given that the cockroaches had to physically engage with the habitat trap as a consequence of their exploratory behavior, whereas the Roach Motel® possesses a pheromone attractant in addition to its physical profile.

The "attractant" of the habitat trap is the narrow space into which cockroaches escape for safety. The current study suggests that this behavior is a powerful force in cockroaches. However, the design of the habitat trap does not exclude the use of another bait. For example, a pheromone could be added to the trap to potentially further increase the efficacy of the trap.

It is believed that the utilization of adhesive on both the floor and the ceiling of the trap increased its efficiency. As the cockroach enters the narrow space and struggles to free its legs from the adhesive on the floor, it pushes its broad dorsal surface up against the adhesive on the ceiling of the space, effectively anchoring the animal to the trap (Fig. 1).

There are limits to the conclusions that can be drawn from these studies. The experimental setup had no "safe" hiding place for the cockroaches. Thus, it is important to examine this trap under "field" conditions where alternative narrow crevices are available for the animals. Furthermore, the concentration of cockroaches per area is much higher in the experimental setup than would occur

under field conditions. This factor may have increased the apparent effectiveness of the traps. Finally, since the efficacy of the trap is dependent on adhesively capturing the cockroach by its dorsal surface, the size of the spacing may be species-specific. If this is true, then a separate trap type would be needed for different target species. In this regard, the sloped ceiling design of Gray (1977) may be superior. Despite these shortcomings, the data suggest that the habitat trap is superior to other widely used baited adhesive traps for the *P. americana*. Field trials are warranted.

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